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volume has been prepared in obedience to this requirement: it is, in part, based on work undertaken by Dr. Smith in 1880, in the preparation of reports on cotton-culture in Alabama and Florida for the tenth census of the United States. The maps and woodcuts engraved for the census-office, and the statistics collected by the enumerators, were placed at his disposal for this report; while the geological material collected by the state survey during previous years was freely contributed to the census report on Alabama. Subsequently additional work has been done by the state survey for this report; and the resulting volume is most creditable, both to the ability of Dr. Smith, and the wisdom of the state in instituting such a survey.

Part i. of the report is introductory in its character, and consists of a general discussion of the composition, mode of formation, and properties of soils, and of the changes produced by cultivation. This discussion, extending over one hundred and fifty-three pages, is admirable of its kind. It does not attempt to present any original observations; but it is a very full and judicious *résumé* of the present state of knowledge on these topics, and shows a much greater familiarity with them than is usually expected from the geologist.

Part ii., which constitutes the report proper, is an account of the main agricultural features of the state of Alabama. Following the tabulated results of the census enumeration, — viz., table i., area, population, tilled lands, and cotton-production; and table ii., acreage and production of leading crops, — we find section i. devoted to an outline of the physical geography and geology of the state, and an enumeration of its agricultural subdivisions; section ii. giving a detailed description of these agricultural subdivisions; section iii., agricultural descriptions of the counties of Alabama; and section iv., cultural and economic details of cotton-production.

For the purposes of agricultural description, Dr. Smith divides the state into three divisions, — a middle, a northern, and a southern. Of these, the middle division is the oldest geologically, and consists of the south-western termination of the Appalachian chain; and the northern is the next in order, consisting of the southern termination of the great Cumberland tableland and of the highlands of Tennessee, together with the Warrior coal-basin. With the exception of bottom and alluvial lands, the soils of this division are sedentary soils, resting upon the rocks from which they were formed; and both the agricultural and topographical features of the country are largely determined by its geological structure.

In the southern division, on the contrary, these features are largely independent of geological structure, and "almost exclusively the result of erosion as determined by differences in the material of a single formation, — the stratified drift or Orange sand, which, except in parts of the prairie belt, covers the underlying beds over this whole division."

The soils of each of these regions are very fully described, the description being in many cases accompanied by chemical analyses and determinations of the more important physical properties. In the middle and northern divisions the classification is chiefly geological, while in the southern it is based mainly on the character of the prevailing forest-growth. A valuable addition to this portion of the report is a list of trees and lesser plants characteristic of the several regions of the state, prepared by Dr. Charles Mohr of Mobile.

The report is illustrated by three geological sections, an agricultural map of the state, and maps showing the distribution of temperature and rainfall for the year, and also for the winter and summer seasons.

LATE ELECTRICAL BOOKS.

Absolute measurements in electricity and magnetism. By ANDREW GRAY. London, *Macmillan*, 1884. 16+207 p., illustr. 24°.

Notes on electricity and magnetism. By J. B. MURDOCK. New York, *Macmillan*, 1884. 8+139 p., illustr. 16°.

MR. GRAY'S book on absolute measurements is the outcome of a series of articles from his pen, upon the measurement of currents and potentials, published in *Nature* in 1882 and 1883: it is, in fact, a reprint of these articles, with some alterations and considerable and important additions; and it must be regarded as a most useful contribution to what may be called the *available* literature upon this subject.

The presentation of the systems of computation, based on the so-called absolute units, is clear and accurate, and will enable the student to obtain a firmer grasp upon the methods now all but universally used than can easily be secured from other sources.

The work opens with a description and discussion of methods of determining the horizontal component of the earth's magnetism, upon which so many electrical measurements are made to depend. Mr Gray is a warm advocate of the use of small masses in this operation, suggesting the use of magnets of

steel wire one millimetre in diameter instead of those found in the common form of magnetometer; and in the deflection experiment he uses the light mirror magnets which are found in Thomson's reflecting-galvanometer. In simplicity and convenience, his plan certainly possesses many advantages, as well as in freedom from certain errors which are likely to exist in the use of the more massive forms. It also has the merit of cheapness, enabling any one, at little expense, to determine this important element with a reasonable degree of accuracy. Neither method, however, is free from disadvantages, to which the author directs further attention in a note.

This discussion is followed by a consideration of the methods of calculating the constants of a coil, and the construction of a standard galvanometer, the latter being described with such attention to details as to leave little to be desired. The author then proceeds to explain the use of the standard galvanometer in the graduation of other forms, selecting for this purpose Sir William Thomson's potential and current galvanometers. The construction of these instruments is described, and the process of graduation which is actually adopted in practice. While it is doubtless true that instruments for the measure of current and electromotive force which satisfy all the demands of the practical electrician have not yet been devised, Sir William Thomson's unquestionably rank high among those at present in use. The most serious error which is likely to result from their employment arises out of the change in the strength of field produced by the permanent magnets, which is pretty certain to occur. Mr. Gray suggests several methods of testing the field of the magnets which furnish valuable checks in their use.

Two or three simple tests which are not referred to will readily suggest themselves to any one making use of the instruments.

The discussion of resistance-measurements, although not exhaustive, covers most of the ground; and especial attention is given to methods of measuring very low resistances, now a matter of greater importance than formerly. A chapter is devoted to the measurement of the energy in electric circuits, which includes a valuable discussion of the theory of alternating-machines and methods especially adapted to them.

One of the most interesting features of the book is a description of several simple and ingenious methods of measuring intense magnetic fields, suggested by Sir William Thomson; and also the use of earth-inductors in absolute measurements, as originally applied by Professor Rowland.

The closing chapter is devoted to a very satisfactory discussion of dimensional equations.

A list of errata accompanies the volume, and several errors not included therein are to be found; but none are of great importance, or likely to mislead the reader; and altogether the book will be welcomed by every student of electricity.

Mr. Murdock's notes are intended to be supplementary to the Elementary lessons in electricity and magnetism by Silvanus P. Thompson, and consist, in the main, of amplifications of some of the propositions in that work, with demonstrations in which a knowledge of the elements of the calculus is assumed. Occasional extensions and additions are also made, which add much to the value of the book. It is likely to be of considerable use to the student of Professor Thompson's elementary lessons, and it may also be used alone with little difficulty. Errors are here and there met with, the most notable of which are to be found in the definitions of units, originating either in gross carelessness, or in a confusion of ideas in the mind of the author. The distinction between work and rate of work, or *activity* as it is happily named by Sir William Thomson, is not regarded in the definitions. A coulomb is defined as an ampère per second. A watt, which is activity, is defined as 10^7 ergs, which is work. The watt and joule are declared identical; although the first is activity, and the second is energy. The joule is defined as a quantity of heat: the suggestion of Sir W. Siemens was, that it should be a unit of work, equal to 10^7 ergs.

Thanks to the efforts of the British association and the international electrical congress, the nomenclature of electrical measurement is well-nigh perfect; and it is both important and easy for the student to acquire in the beginning clear and accurate conceptions of the nature and relations of the units involved. Is there not, however, a tendency at the present time to overdo the matter of creating and naming units? Too many will complicate rather than simplify processes of computation. The use of 'joule' does not seem to be altogether free from criticism, on account of the fact that the same name, or at least the initial *J*, has long been in use as the symbol for the mechanical equivalent of heat. There does not appear to be any good reason for making a unit of the current which will evolve one cubic centimetre of mixed gases per minute, and

calling it a 'jacobi,' as all derived units should be related to the fundamental units of length, mass, and time, through simple, decimal ratios.

There is danger, in fact, of the simple elegance of the absolute system being destroyed by excessive ornamentation; and it is well enough to make haste slowly in adding to what has already been done.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Paleontology. — Prof. H. S. Williams, from his preliminary study of the specimens he collected during last season in Genesee and Wyoming counties, N.Y., from the Genesee slate and Portage formations, reaches some interesting conclusions. He is convinced that the black shales which appear in the lower Portage of this region, and continue to appear as thin zones up to a point just below the Portage sandstones, represent merely an interrupted continuation of the deposits called the Genesee slates. After the typical Genesee slate was deposited to some considerable thickness, the Portage fauna made its appearance in the soft, blue, argillaceous shales. A hundred feet higher another black shale appears of several feet thickness, and then olive shales come in; and for several hundred feet this alternation continues, the black shales becoming thinner with each repetition, and containing an increasing amount of impurity, siliceous and argillaceous, so that in the upper part there are only dark-gray bands or streaks of the olive shales, with fine paper-like layers of black. The earlier Portage black slates bear the same fauna as the Genesee, but the specimens are fewer. Although these black slates are interstratified with the olive shales, they do not contain the Portage fauna. It is confined to the olive layers, and, higher up, to the bluish argillaceous shales. Near the top of the Portage series the sandstones come in. They are of a light-gray color, and are generally calcareous. They frequently have a petroleum-like odor. With them the Chemung fauna is associated. The lowest observed appearance of that fauna was in Java township, Wyoming county, in the first of the gray sands lying just above the last-observed black zone, which was bituminous.

Professor Williams also says that some interesting features have been revealed by the study of a large series of specimens of Spirifera mesocostalis Hall. In the representatives of the species from the upper Devonian, there is a well-developed median septum in the ventral valve, as in the genus Spiriferina; but the punctate character of the shell of that genus has not been observed in any of the specimens. The lower forms, at its first appearance in the Ithaca group, very rarely show any trace of the septum. As far as Professor Williams's examination has gone, he finds that the median septum is more fully developed and more generally present, the higher up the specimens are found. In harmony with this observation is the reference, by Mr. Whitfield, of a similar specimen from Wisconsin (Geol. Wisconsin, iv. 332) to Spiriferina under the name of Spiriferina (?) ziczac.

STATE INSTITUTIONS.

New-York state survey.

Rainfall of western New York. — To ascertain how much water is likely in different seasons to flow off of the surrounding watershed into Oak-Orchard Swamp, it was necessary to study with great care the rainfall of the western part of the state for the past fifty years. A careful analysis was therefore made of observations taken at Rochester university since 1830, and by the U. S. signal-service at Buffalo and Rochester since 1870. The result of this discussion of the Rochester rainfall is quite remarkable. It is shown, that from 1830 to 1880, during the very period when the woods were being cut off from the western part of the state, the rainfall steadily increased from a mean annual precipitation of 27.7 inches to 38 inches. The average was 34 inches. From 1868 to 1881 inclusive, there was the greatest average rainfall known for a similar period in that locality: it was 38.73 inches. The greatest recorded monthly, daily, and spring rainfalls occurred between 1870 and 1880. This decennial period is therefore a safe one from which to estimate maximum amounts of water likely to be discharged from watersheds in the western parts of the state; but towns whose future water-supply is estimated from the amounts received into lakes or streams since 1868 may find themselves very short of water, if the mean annual precipitation should decrease to that of the period from 1830 to 1840. Long periods of small average rainfall will doubtless recur in the region near Lake Ontario. The city of Rochester should be prepared for a time when, for ten years, the average yield of water from its present source of supply, the basin of Hemlock Lake, may amount to only three-quarters of the average flow from 1868 to 1881.

Quantity of water evaporated from various watersheds. — While the mean rainfall of this region has increased during the past fifty years, the summer flow of the streams has greatly diminished. This is due partly to the loss of retaining-power in the ground, owing to the removal of the soft forest mould, which in former times readily absorbed the rain and melting snows, and so prevented these invaluable waters from rushing off and wasting themselves in destructive floods, and partly to the enormous increase in evaporation. The proportion of rainfall, which, owing to evaporation, is lost for use in springs, lakes, and streams, is known to but few. In the special